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The relationship between physical activity, sedentary behavior and work engagement

Licenciate study

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Contents

Tiivistelmä

HELSINGIN YLIOPISTO - HELSINGFORS UNIVERSITET - UNIVERSITY OF HELSINKI

Tiedekunta - Fakultet - Faculty	Laitos - Institution – Department
Käyttäytymistieteellinen tdk	Psykologian oppiaine

Tekijä - Författare - Author

Heli Rautjärvi

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Tiivistelmä - Referat - Abstract

Työn imulla (engl. work engagement) tarkoitetaan myönteistä tunne- ja motivaatiotäyttymyksen tilaa, jota luonnehtivat tarmokkuus, omistautuminen ja uppoutuminen (Schaufeli, Bakker, & Leiter, 2010; Schaufeli, Salanova, Gonzalez-roma, & Bakker, 2002). Modernissa työelämässä työn imua voidaan pitää yhtenä käyttökelpoisimmista tuottavuuden ja hyvinvoinnin mittareista niin yksilö- kuin ryhmätasolla. Työn imua selittäjineen on viime vuosina tutkittu paljon. Samaan aikaan käsityksemme fyysisen hyvinvoinnin yhteydestä henkiseen hyvinvointiimme on tarkentunut koko ajan. Liikkumisen (engl. physical activity) lisäksi liiallisen paikallaanolon (engl. sedentary behavior) välttäminen on todettu tärkeäksi keinoksi tukea tätä kokonaisvaltaista hyvinvointia. Tähän mennessä kuitenkin vain harvoissa tutkimuksissa on selvitetty liikkumisen, paikallaanolon ja työn imun välisiä yhteyksiä. Tässä tutkimuksessa selvitettiin miten nämä kolme ovat yhteydessä toisiinsa.

Tutkimus tehtiin osana Liike Elämään -hanketta. Kyselyaineisto kerättiin 12 suomalaisesta pienestä ja keskisuuresta yrityksestä (n = 289), ja analysointiin tutkittujen käsitteiden osalta korrelaatio- ja regressioanalyysein. Tulokset osoittivat, että vähintään kohtuutehoinen viikoittainen liikkuminen oli itsenäisesti yhteydessä työn imun kanssa, mutta paikallaan oloa kuvaavan päivittäisen istumisen ja työn imun väliltä ei löytynyt yhteyttä. Lisäksi työntekijöiden arvio omasta terveydestään oli yhteydessä sekä työn imun että liikkumisen kanssa.

Tulosten perusteella voidaan sanoa, että etsittäessä työn imua kokevia, eli hyvin suoriutuvia, sitoutuneita ja hyvinvoivia työntekijöitä, on tärkeää panostaa myös työntekijöiden liikkumisen ja hyvän terveydentilan tukemiseen. Istumisen merkitys työn imun näkökulmasta vaatii lisätutkimusta. Työntekijöiden työn imun ja liikkumisen tukeminen haastaa niin organisaatioiden johdon, työntekijät itsensä kuin työterveyshuollon tukemaan toisiaan ja työskentelemään toistensa ammattitaitoa hyödyntäen tätä yhteistä tavoitetta kohti.

Avainsanat – Nyckelord - Keywords

työn imu, liikkuminen, paikallaanolo

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Abstract

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Tiivistelmä - Referat - Abstract

Work engagement means a positive state of work-related wellbeing characterized by vigor, dedication and absorption (Schaufeli, Bakker, & Leiter, 2010; Schaufeli, Salanova, Gonzalez-roma, & Bakker, 2002). In modern working life, it can be considered as one of the most useful measures of productivity and wellbeing of a single employee or team. Research has found many antecedents of work engagement. At the same time our knowledge of physical wellbeing related to mental wellbeing increases all the time. Sufficient physical activity combined with avoiding too sedentary lifestyle has been found to be one important way of supporting this holistic wellbeing. However only few studies have explored the relationship between physical activity and/or sedentary behavior and work engagement. In present study, I wanted to explore the association between these three topical wellbeing constructs.

The study was part of Liike Elämään -project. The study was based on self-evaluating questionnaire data on 12 Finnish small- to medium-sized companies from different industries around Finland (n = 289). Results showed that weekly moderate to vigorous physical activity was associated with work engagement but sedentary behavior, operationalized as daily sitting, was not. Respondents' self-evaluated health was meaningful for both the experience of work engagement and the amount of physical activity.

From these results we can conclude that when looking for engaged, that is well performing and wellbeing, employees, it is also important to invest in supporting employees' physical activity and perceived health. The role of sedentary behavior in relation to work engagement requires more research with multiple methods. Supporting employees' work engagement and physical activity challenges both management, employees themselves and occupational healthcare professionals to support each other and work together towards this common goal, utilizing one another's expertise.

Avainsanat – Nyckelord - Keywords

work engagement, physical activity, sedentary behavior

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Helsingissä 29.11.2016

Heli Rautjärvi

Introduction

Supporting and promoting **work engagement** has been shown to be beneficial to both employees themselves and to employers (see Kim, Kolb, & Kim, 2012; Torp et al., 2013). Antecedents of work engagement have been under interest of researchers and practitioners for the last ten years. At the same time research has further extended our understanding of the importance of **physical activity** to our health and overall wellbeing (for a review see Hills, Street & Byrne, 2015; Penedo & Dahn, 2005). One of the most recent research topics on this field has been **sedentary behavior** which seems to be an independent risk factor to many severe diseases and lack of wellbeing (Van Uffelen et al., 2010).

There are only few previous studies about physical activity and work engagement, and even fewer about sedentary behavior and work engagement. The aim of present study is to examine associations between physical activity, sedentary behavior and work engagement, as well as its components (vigor, dedication and absorption).

Work engagement as an indicator of productivity and wellbeing

Work engagement means a positive, fulfilling, affective-motivational state of work-related wellbeing that is characterized by vigor, dedication, and absorption (Schaufeli, Bakker, & Leiter, 2010; Schaufeli, Salanova, Gonzalez-roma, & Bakker, 2002). It's not a momentary "peak experience" as what is meant by a concept of *flow* (Csikszentmihalyi, 1997) but more sustainable and wider reaching state of motivation and inspiration (Hakanen, 2009).

Engaged employees have high levels of energy and mental resilience while working, in other words they experience *vigor* (Bakker, Schaufeli, Leiter, & Taris, 2008). They are enthusiastic about and

committed to their work, referred by *dedication* (Bakker, Schaufeli, Leiter, & Taris, 2008). Finally, *absorption* refers to employees being often fully immersed in their job so that time flies (Bakker, Schaufeli, Leiter, & Taris, 2008). Despite of high level of commitment, engaged employees feel working is fun and they also enjoy other things outside work (Bakker, Albrecht, & Leiter, 2011).

Research has found several antecedents of work engagement: Job resources, such as autonomy, social support, and skill variety (Bakker & Demerouti, 2007), and personal resources like self-esteem, optimism, and self-efficacy (Xanthapolou et al., 2007), are important predictors of work engagement (for a review see Bakker et al., 2011). Charismatic (Babcock-Roberson & Strickland, 2010), transformational and empowering leadership style (Salanova et al., 2011) support work engagement. Work engagement is contagious between individuals in the same work group (Bakker et al., 2011). It's also been shown that engaged employees craft their job to stay engaged (Bakker et al., 2011; Hakanen, Perhoniemi, & Toppinen-Tanner, 2008). Better recovery experiences (psychological detachment from work, relaxation, mastery and control during off-job time) increase vigor at work (ten Brummelhuis & Bakker, 2012; Kinnunen, Mauno, & Siltaloppi, 2010). Munir et al. (2015) found in their recent study that employees with less prolonged occupational sitting times have higher work engagement.

In most organizations success and profitability are the result of combined effort of individual employees. As work engagement is contagious and in many ways closely related to good work performance and motivation (Bakker, 2011), it's conceivable that engagement among members of the same work team increases performance (Bakker et al., 2008). Work engagement is positively associated with organizational commitment (Hakanen, Schaufeli & Ahola, 2008) and work-family enrichment (Hakanen, Peeters & Perhoniemi, 2011). Engaged employees are committed to their work (Hakanen, Bakker, & Schaufeli, 2006), perform well and act

proactively (e.g., Hakanen, 2009; Salanova & Schaufeli, 2008; Xanthopoulou et al., 2009). Engaged employees have less sickness-absences from work (Schaufeli, Bakker, & Van Rheenen, 2009).

Besides of performing well engaged employees are in many ways healthier and more wellbeing than non-engaged ones. They have less depressive symptoms and more life satisfaction (Hakanen & Schaufeli, 2012). Work ability of engaged employees is better than that of their less engaged co-workers (Airila et al., 2012). Work engagement is associated even with healthy, adaptable cardiac autonomic activity (i.e. healthier heart) (Seppälä, et al., 2012).

Hakanen and Schaufeli (2012) suggest that experiences at work, including engagement, might be even more important to individual's general wellbeing and mental health over time than many other issues in life. Thus, as Bakker (2011) puts it, it might be justifiable to say that work engagement is a better predictor of job performance and well-being than many other constructs. Hereby, for both productivity and health reasons, it's crucial for any employer and work community to focus on increasing employees' work engagement to improve effectiveness and wellbeing of both individuals and whole organization.

Physical inactivity and sedentary behavior as risk factors for occupational health

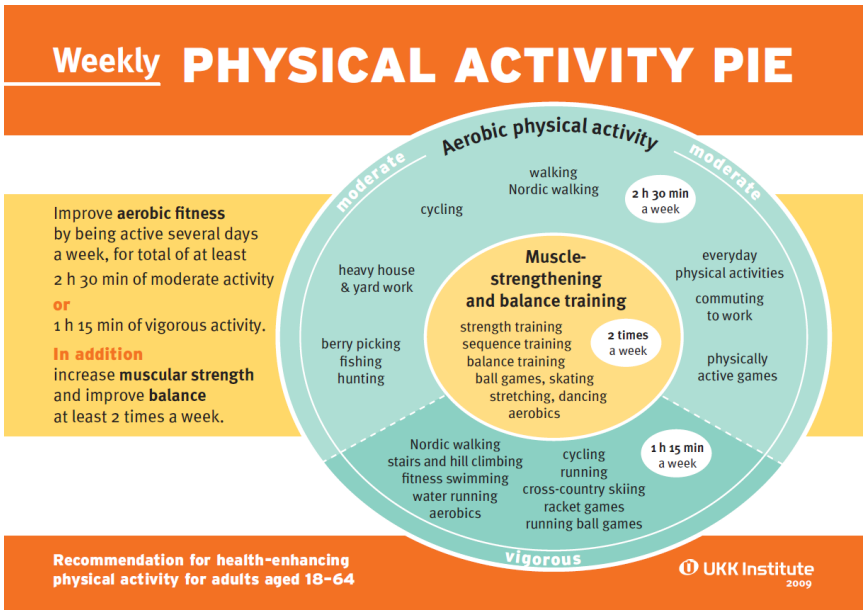
Physical activity means all volitional muscular movement that increases energy expenditure (Caspersen et al., 1985). According to World Health Organization WHO (2011) insufficient physical activity is globally the fourth biggest reason for preliminary mortality. Regular physical activity on the other hand enhances health and diminishes the risk for diseases (Physical Activity Guidelines Advisory Committee, 2008).

Besides of positive influence on physiological health, physical activity has many positive effects on mental health as well. Physical activity reduces the risk of depression (Mammen & Faulkner, 2013) and may even treat it (Krogh, Nordentoft, Sterne & Lawlor, 2010; Robertson et al., 2012). Physical activity, and possibly workplace interventions concerning it, have been found to improve worker stress levels (Sliter, Sinclair, Cheung, & McFadden, 2014; Tonello et al., 2014). Physical activity is associated with recovery of work and burnout symptoms (Teisala et al., 2014).

For health and wellbeing, any physical activity is better than staying still or sedentary but especially moderate to vigorous physical activity has been found to have positive health effects (Hills, Street & Byrne, 2015). More than 150 minutes of physical activity per week is also recommended by many professionals (Mammen & Faulkner, 2013).

Finland uses the internationally widely adopted recommendations for health-enhancing physical activity for adults aged 18-64 years (Physical Activity Guidelines Advisory Committee, 2008), which are visualized in “Physical Activity Pie” (picture 1).

PICTURE 1. Physical Activity Pie (UKK Institute, 2009)



For improving aerobic fitness adults are supposed to be physically active at least 2 h 30 min on moderate intensity or 1 h 15 min on vigorous intensity, weekly. In addition, adults are supposed to be physically active for increasing muscular strength and improving balance at least two times a week.

Despite of physical activity it seems that avoiding too much time spent sedentary is also important for overall health (de Rezende et al., 2014). *Sedentary behavior* means any waking behavior characterized by an energy expenditure ≤ 1.5 metabolic equivalents (=METs) while in a sitting or reclining posture (Tremblay, 2012). Hereby it's not the same thing as *physical inactivity* which in turn means insufficient amount of moderate- to vigorous-intensity physical activity (Tremblay, 2012). Sedentary behavior has been found to be independently associated with many health risks, such as overweight and obesity, and chronic diseases including cardiovascular disease, Type 2 diabetes, even cancer (Proper, Cerin, Brown, & Owen, 2007; Hamilton, Hamilton, & Zderic, 2007; Marshall & Gyi, 2010; Van Uffelen et al., 2010; de Rezende et al., 2014). It seems that especially leisure screen time, at least for

adolescents, is associated with poorer mental health, such as depressive symptoms, anxiety and stress (Hoare et al., 2016).

Regardless of age or sex Finnish adults spend on average 76% (9 hours) of their awake time staying still, mostly sitting (Husu et al., 2014). Besides of the recommendation for physical activity, also the very recent recommendation of daily sedentary behavior (Finnish Ministry of Social Affairs and Health, 2015), that is maximum seven hours of staying still, is exceeded (Husu et al., 2014).

Research suggests that too much sitting (i.e. sedentary behavior) and too little moderate to vigorous physical activity (i.e. physical inactivity) represent separate and distinct risk factors of health problems (for example see Biswas et al., 2015; Tremblay, 2012). However, in Finland, as in many western countries, adults spend most of their awake time still, mostly sitting, and move insufficiently (Husu et al., 2014).

Physical activity and sedentary behavior in relation to work engagement

As described above both physical activity and sedentary behavior have many associations with physical and mental wellbeing, both on worktime and leisure. Hence, it's reasonable to assume that physical activity and sedentary behavior might also have associations with work engagement.

However, in their exploratory study of associations between moderate to vigorous physical activity (MVPA), mental health, and work engagement van Berkel et al. (2013) found no statistically significant associations between these phenomena. Study was based on both self-reported estimations of moderate to vigorous physical activity, mental health and work engagement, and objectively measured MVPA but results were same with both measurement ways. However, it has been found that off-job activities that enable

employees to psychologically detach from work, as physical activities or exercising, enhance vigor on the following morning and this way increase work engagement during the day (ten Brummelhuis & Bakker, 2012). As stated earlier, it has also been shown that physical activity buffers stress (Sliter, Sinclair, Cheung, & McFadden, 2014) and is associated with recovery of work and burnout symptoms (Teisala et al., 2014).

Munir et al. (2015) found that prolonged occupational sitting time diminishes work engagement with both men (vigor and dedication) and women (vigor). Only women with high absorption were likely to have prolonged sitting times (Munir et al., 2015). In other studies, sedentary behavior has been recognized to be a risk factor not only of many bodily diseases (de Rezende et al., 2014) but also of mental problems as depression (Zhai, Zhang, & Zhang, 2014; Hoare et al., 2016).

There are only few studies found by date examining associations between moderate to vigorous physical activity and work engagement, or sedentary behavior (operationalized as sitting time) and work engagement (van Berkel et al., 2013, Munir et al., 2015). I found no study that combines all these three concepts of occupational wellbeing and health.

Aim of this study

In this study, I wanted to examine whether there is connection between physical activity and/or sedentary behavior, and work engagement or its components. Based on the ongoing trend of positive psychology and increasing knowledge of the co-work of our bodies and minds it is justified to hypothesize that health increasing behaviors of sufficient physical activity and diminished sedentary behavior might be related to work engagement. However, as shown

above, there's very limited amount of research of the associations between these three.

The hypotheses in this study were that, 1) physically more active employees report higher work engagement; 2) physical activity correlates positively with the components of work engagement, especially vigor. It was also hypothesized that 3) less sedentary behavior (measured as sitting time on working days) is associated with work engagement. The only exception might be absorption which might have positive association with sedentary behavior.

Methods

This study is part of "Moving to business" project which aims at promoting physical activity and reducing sedentary behavior among employees in small- and medium-sized Finnish workplaces (Aittasalo et al., *submitted*). Moving to business -project was designed and evaluated by two research organizations (The UKK Institute for Health Promotion Research – UKK-Instituutti, and the Finnish Institute of Occupational Health - Työterveyslaitos), and financed and implemented by the Finnish Sports Confederation (Valtakunnallinen liikunta- ja urheiluorganisaatio VALO) in collaboration with three regional sports federations. The project was implemented during 2013-2015.

Participants and procedure

The project and research as a part of it were implemented in twelve Finnish workplaces in three different cities. Attended organizations were recruited by three regional sports federations. Number of employees per workplace varied from 11 to 107. Workplaces represented e.g. financial and insurance activities, information and

communication, arts, entertainment and recreation, education and manufacturing. Data was collected before and after implemented interventions by a paper questionnaire and a triaxial accelerometer on autumn 2013 and 2014. The questionnaire data from the baseline measurement in autumn 2013 was used in this study because the accelerometer data was not yet available. In this study, only baseline data was used as the interest was to explore basic associations between physical activity and work engagement, and sedentary behavior and work engagement.

Altogether 296 employees of 396 (74,7 %) completed the questionnaire. Because of missing data seven participants were excluded and hence the answers of 289 participants were used in elaborated analysis for this study.

Measures

Used data was collected by a self-administered questionnaire consisting of 45 questions about e.g. respondents' demographics, work, work ability, work engagement and recovery, physical activity, sedentary behavior, perceived health, smoking and sleep (Aittasalo et al., *submitted*).

Work Engagement

Work engagement was measured with Finnish version of 9-item Utrecht Work Engagement Scale (UWES-9) (Hakanen, 2009; Schaufeli, Bakker, & Salanova, 2006; Seppalä et al., 2009). In UWES-9 responses are given on a seven-point Likert scale from 0 (never) to 6 (daily). A mean score is calculated for total work engagement and its' components vigor, dedication and absorption. UWES-9 has good construct validity and use of this 9-item version (instead of original 17-item) is recommended by researches (Seppalä

et al., 2009). Reliability of UWES-9 was very good in the present study, with Chronbach's Alphas being 0.93 for total work engagement and between 0.91 and 0.93 for its subscales.

Physical activity

The questions on the quantity of weekly physical activity were the same as used in Finnish population surveys (Helldan et al., 2013). For this study, responses to the weekly frequency and duration of moderate to vigorous physical activity were combined to form a total amount of weekly moderate to vigorous physical activity, MVPA. Examples of the modes of physical activity were included in the intensity-specific questions to help respondents in their assessment (as "some sweating or intense breathing, for example fast walking"). Reported hours and minutes were summarized to form the total amount of weekly MVPA. The recommendations for health-enhancing physical activity (Physical Activity Guidelines Advisory Committee, 2008) emphasize the significance of MVPA. It might also be easier to evaluate the amount of exercise than random and less intense "moving around" (Matthews et al., 2012). For these reasons weekly MVPA, specifically, was selected as studied variable.

Sedentary behavior

In present study sedentary behavior was operationalized as sitting time. The questions were identical with Workforce Sitting Questionnaire, which has been found acceptably valid for assessing sitting time at work and total sitting time during working and non-working day (Chau et al. 2011). Again, to assist respondents, the question on sitting time was divided into smaller parts according to the context ("at work / home watching tv / home on computer / in a

vehicle / elsewhere"). In the analysis the sitting minutes spent in different contexts were added up and the sum accounted for the total duration of daily sitting. Only sitting time on a working day was included in the analysis as the interest of this study was on wellbeing at work: work engagement occurs at work so it's justifiable to use working day sedentary behavior as independent variable as well.

Covariates

Choice of covariates was based on their relevancy in relation to work engagement (Hakanen, 2009). Covariates used in this study included participants' age, sex, educational level (asked on six-point scale and divided to three categories of comprehensive or lover vocational level, higher vocational level, and university level), working hours (asked on six-point scale and divided to two categories of regular day work or other), BMI (self-reported weight/height, $kg/cm^{2,}$, continuous), and self-reported health (five-point scale of "poor", "fairly poor", "average", "fairly good", "good", re-categorized to average or worse, fairly good, and good). As smoking is often controlled in studies concerning health, it was also included as a covariate here (currently – yes or no; previously – yes or no) (see for example Airila et al., 2012).

Statistical analysis

Work engagement with its subscales were skewed to left and were therefore square transformed. Weekly MVPA was skewed to right and therefore square root transformed to achieve normal distribution. BMI was skewed to left and hence rank-order normalized according to Bloom's formula. Continuous variables were standardized to facilitate comparison of effect sizes.

Pearson correlations were counted for the associations between study variables. Spearman correlations were counted for variables on nominal scale. A t-test was conducted to examine the differences in these variables between men and women. The associations between weekly MVPA, sitting time on a working day, and work engagement were tested in four different linear regression models. Model 1 was adjusted for age and sex. Model 2 was adjusted for age, sex, educational level, working hours, BMI and smoking. Model 3 was adjusted for age, sex and self-reported health. Finally, Model 4 was adjusted for all these studied variables. All analysis was made using SPSS Statistics program (version 22.0, IBM).

Results

The characteristics of the sample are shown in Table 1. Of the respondents, 64 % were men. The mean age of study population was 42.5 years (SD 10.9). Of the participants, 84 % of women and 56 % of men had higher vocational education or university degree. Most participants had regular day job (80% of women and 64% of men). BMI of participants was approximately 25.6 (SD 4.5). Women scored higher in work engagement than men (women 4.94 and men 4.70, $p < 0.05$), especially in absorption (women 4.94 and men 4.54, $p < 0.05$). Women's sitting times were higher than men's (women 9.10 h per day and men 7.41 h per day, $p < 0.05$). Finally, it was also tested if the associations between key variables (work engagement, weekly MVPA, sitting time) were different for men and women but no significant differences were found (all p-values > 0.05). Included and excluded participants didn't differ on any studied variables.

TABLE 1. Characteristics of the study sample

Study participants (N = 289)					
Variable	**range**	**M**	**SD**	**n**	**%**
Age	22-65	42.53	10.9		
Gender					
women				104	36
men				185	64
Education					
academic				77	27
higher vocational				137	47
compr., college/voc.				75	26
BMI	17.6-52.0	25.58	4.54		
Self-reported health	1-5	3.99	0.85		
Smoking				45	16
Working hours (regular daywork)				214	74
Weekly MVPA (hours)	0-21	2.59	2.60		
Daily sitting time (hours)	2.75-15.25	8.50	2.35		
Work engagement	0.89 - 6.00	4.85	0.91		
vigor	1.33 - 6.00	4.85	0.97		
dedication	0.67 - 6.00	4.92	1.05		
absorption	0.67 - 6.00	4.78	1.05		

Bivariate Pearson's correlations between continuous and Spearman's correlations between nominal main variables are shown in Table 2.

TABLE 2: Bivariate associations between key variables

	1.	2.	3.	4.	5.	6.	7.	8.	9.	10.	11.
1. Age	1.00										
2. Sex	-.02	1.00									
3. Educational level	-.12*	.27**	1.00								
4. BMI	.11	-.17**	-.16**	1.00							
5. Self-reported health	-.16**	-.02	.09	-.25**	1.00						
6. Daily sitting time	.03	.33**	.31**	.01	-.08	1.00					
7. Weekly MVPA	-.01	.07	.08	-.19**	.25**	-.05	1.00				
8. Work engagement	.05	.13*	.12*	-.07	.23**	.04	.13*	1.00			
9. Vigor	.02	.08	.09	-.06	.33**	-.01	.17**	.89**	1.00		
10. Dedication	.07	.06	.09	-.03	.17**	.02	.07	.92**	.76**	1.00	
11. Absorption	.03	.19**	.14*	-.10	.13*	.08	.11	.87**	.62**	.71**	1.00

** Correlation is significant at the 0.01 level (2-tailed)

* Correlation is significant at the 0.05 level (2-tailed)

Age correlated negatively with educational level ($r = -0.12$, $p < 0.05$) and self-reported health ($r = -0.16$, $p < 0.01$) so that younger were more educated and healthier. Better self-reported health correlated positively with lower BMI ($r = -0.25$, $p < 0.01$) and higher MVPA ($r = 0.25$, $p < 0.01$). Also, higher educational level correlated positively with lower BMI ($r = -0.16$, $p < 0.01$). On the other hand, higher educational level was related to higher level of daily sitting time (r =

0.31, $p < 0.01$). Higher MVPA was related to higher work engagement ($r = 0.13$, $p < 0.05$). Higher educational level ($r = 0.12$, $p < 0.05$), and better self-reported health ($r = 0.23$, $p < 0.01$) were also related to higher work engagement.

Of work engagement's components, higher vigor was related to higher MVPA ($r = 0.17$, $p < 0.01$) and better self-reported health ($r = 0.33$, $p < 0.01$). Higher dedication was associated with better self-reported health ($r = 0.17$, $p < 0.01$). Higher absorption was related to better self-reported health ($r = 0.13$, $p < 0.05$) and higher educational level ($r = 0.19$, $p < 0.01$).

The results of regression analyses of associations between MVPA and work engagement, and sitting time and work engagement are shown in Table 3. Associations were tested in four regression models. In Model 1 only age and sex were controlled. Model 2 was adjusted for age, sex, educational level, working hours, BMI and smoking. Model 3 was adjusted for age, sex and self-reported health. Finally, Model 4 was adjusted for all studied variables.

TABLE 3. Associations between physical activity and work engagement tested in four regression models

	Model 1			**Model 2**			**Model 3**			**Model 4**		
	B	Beta	p-value	B	Beta	p-value	B	Beta	p-value	B	Beta	p-value
Age	.05	.05	.353	.08	.08	.170	.09	.09	.139	.11	.11	.059
Sex	.25	.12	**.039**	.27	.13	**.047**	.27	.13	**.026**	.30	.14	**.024**
Educational level												
high				-.44	-.22	**.003**				-.40	-.20	**.006**
low				-.23	-.10	.188				-.23	-.10	.194
Working hours (regular daywork)				-.17	-.07	.233				-.18	-.08	.195
Smoking												
currently				.04	.01	.835				.12	.04	.485
previously				-.01	-.01	.919				.02	.01	.905
BMI				.02	.02	.786				.06	.06	.354
Self-reported health												
fairly good							-.31	-.15	**.024**	-.30	-.15	**.030**
worse							-.59	-.27	**.000**	-.62	-.28	**.000**
Weekly MVPA	.12	.12	**.046**	.12	.11	.062	.06	.06	.352	.06	.06	.299

Model 1: age and sex

Model 2: age, sex, educational level, working rhythm, smoking, BMI

Model 3: age, sex and self-reported health

There was significant association (Beta = 0.12, $p < 0.05$) between work engagement and weekly MVPA when age and sex were controlled. Association was marginally significant ($p = 0.062$) when also educational level, working hours, BMI and smoking were controlled. However, self-reported health removed this association (models 3 and 4). Daily sitting time was not associated with work engagement in any tested models.

Vigor was significantly associated with MVPA as hypothesized (Beta = 0.160, $p = 0.006$). Association remained significant when also other covariates, that is educational level, working hours, BMI and smoking, were controlled (Beta = 0.148, $p = 0.016$). When self-reported health was controlled, the associations between MVPA and work engagement attenuated to non-significance. MVPA was not associated independently with dedication or absorption. Daily sitting time was not related to work engagement or any of its components.

Discussion

This study examined the relationship of physical activity (operationalized as weekly moderate to vigorous physical activity, MVPA) and sedentary behavior (operationalized as daily sitting time) with work engagement in small- and medium-sized Finnish organizations. Physical activity was associated with work engagement as hypothesized: respondents that were physically more active reported higher work engagement, especially vigor. Physical activity however didn't have independent associations with other components of work engagement, that is dedication and absorption. There was no relationship between sedentary behavior and work engagement.

Physical activity is related to higher work engagement

Weekly moderate to vigorous physical activity was associated with work engagement when controlled by age and sex. The association remained marginally significant when also education level, working hours, BMI and smoking were controlled. However, taking self-reported health into account attenuated the association between physical activity and work engagement to non-significance.

The present results are not completely in line with previous findings. In their exploratory study van Berkel et al. (2013) found no statistically significant associations between moderate to vigorous physical activity, mental health and work engagement. Number of respondents was close to present study (n = 257). Both physical activity and work engagement were self-reported as in the present study. There was no big difference in used measures either, as van Berkel et al. (2013) used UWES-17 for work engagement and Short Questionnaire to Asses Health Enhancing Physical Activity, SQUASH (Wendel-vos et al., 2003), for moderate to vigorous physical activity. Hence the difference between results in their study and present study must be explained in some other way. In present study respondents were chosen based on companies' self-imposed will to advance their everyday physical activity and possibilities to do sports supported by the employer. This positive and supportive handover from employee might orient respondents' focus so that they report higher values of work engagement than usually. Besides of reporting positively, perhaps employees attending studies like this, already feel working is fun and they feel well too. It's also possible that organizations involved in present study were already positively oriented to both physical activity and signs of work engagement.

There are similar results as in present study of positive associations between detachment from work, for example by exercising, and work engagement (ten Brummelhuis & Bakker, 2012). It has also

been shown that physical activity buffers stress (Sliter, Sinclair, Cheung, & McFadden, 2014) and is associated with recovery of work and burnout symptoms (Teisala et al., 2014). Hence finding positive relation between physical activity and work engagement is not totally surprising but on the contrary more expected, as was also hypothesized.

Sedentary behavior and work engagement

Sedentary behavior (operationalized as sitting time during a working day) was not associated with work engagement, or any of its' components, in the present study. Munir et al. (2015) have however reported that prolonged occupational sitting time diminishes work engagement. As was also hypothesized in present study concerning sitting time during working day, in the study of Munir et al. (2015) work engagement was higher with both men and women with lover occupational sitting times. Only women with high absorption were more likely to have prolonged sitting times (Munir et al., 2015). There may be several reasons for different results between present study and Munir's et al. (2015) findings. First of all, occupational sitting time and sitting time during the whole working day are not completely the same concepts. Munir et al. (2015) had large study sample (n = 4436) of Irish office-based public sector employees. UWES-9 (Schaufeli, Bakker, & Salanova, 2006) was used to measure work engagement, and the Domain-Specific Sitting Time Questionnaire (Marshall et al., 2010) for self-reported occupational sitting times. In present study sample was smaller (n = 289) and consisted of both office-based and other employees whose work includes less sitting than in office-work. Association between sitting time and work engagement may not be as clear on occupations where there is only little sitting at work in general. It's also possible that questionnaire didn't give information accurate enough of respondents' sitting times. To avoid this possible flaw, it would be

interesting to see whether these associations existed when sitting time was measured objectively by accelerometer instead of questionnaire. All in all, the role of sedentary behavior in relation to work engagement requires more research with multiple methods.

Self-reported health and work engagement

Self-reported health was associated with higher level of weekly moderate to vigorous physical activity and higher work engagement. Both physical and mental health have been found to be associated with work engagement in many earlier studies (for example Airila et al., 2012; Hakanen & Schaufeli, 2012; Seppälä, et al., 2012). It's known that regular physical activity, especially on moderate to vigorous intensity, enhances health and diminishes diseases (Hills, Street & Byrne, 2015; Physical Activity Guidelines Advisory Committee, 2008). This way it's understandable that employees feeling healthy and well also have energy to be physically active and experience work engagement. Whether there is causality between these different sides of wellbeing, and which are the supporting mechanisms between these three, is a field of research always interesting and developing.

Strengths and limitations of this study

When interpreting the results of present study, it's good to pay attention to some limitations as well. The study population might have been positively selected as respondents signed up based on companies' self-imposed will to advance their everyday physical activity and possibilities to do sports supported by the employer. Only the data from baseline measurement was used in this study so there's no information of causal relations between physical activity and work engagement. As only the questionnaire data was used, all information is based on respondents' self-evaluation. From earlier

research, it's known that people tend to overestimate their physical activity when evaluating it on questionnaires (Hagstromer et al., 2010; van Poppel et al., 2010). Also, Husu et al. (2014) pointed out that less than a quarter of Finnish people fulfils recommendations for health-enhancing physical activity (picture 1) when measured objectively with triaxial accelerometer instead of self-evaluation (Husu et al., 2014). Moderate physical activity takes 4% and vigorous physical activity only 1% of adults' day (Husu et al., 2014). This same evaluation error is most likely visible in the results of present study as well.

On the other hand, also short activity bursts that break sitting at least for some moments are shown to be beneficial for health (Healy et al., 2008). This kind of short-term everyday moving around is difficult to self-report (Husu et al., 2014; Matthews et al., 2012) and so is easily left out from questionnaire responses. In present study, only moderate to vigorous physical activity was taken into account, not lower intensity "moving around". Also daily sitting time was reported based on self-evaluation. These issues also make it challenging to know what's the final association between physical activity or sedentary behavior and work engagement. That's way it's important to continue studying the associations and effects between these three, using multiple methods of both self-evaluation and objective measurement.

Despite of limitations there are also many strengths in present study. Promoting both physical and psychological wellbeing of employees' is potentially beneficial not only to the employees themselves but also to employers (Lerner et al., 2013; Conn et al., 2009). Because of this, it's recommendable to reduce sitting time and promote physical activity as part of health-enhancing behaviors on workplace. At the same time, it's crucial to take care of employees' mental wellbeing which is an irreplaceable tool for almost any job in today's society. The present study, for its part, increases the understanding of the connection between physical (i.e. physical

activity and sedentary behavior) and psychological (i.e. work engagement) wellbeing at work.

There's no previous study of physical activity and sedentary behavior as antecedents of work engagement in Finland. Hence present study can be considered as new and informative. Work engagement, physical activity and sedentary behavior are all practical everyday concepts of occupational well-being. That's why it's easy to find practical implications of these research results for both employers, employees themselves, occupational healthcare professionals and researchers.

Conclusions: Boosting wellbeing in occupational healthcare

Employed adults spend half of their workday waking hours at workplace, so workplace habits, surroundings and conditions play big role in their lives. Because of technological development over the last decades, the nature of work has changed less physical, and more mentally and emotionally demanding. At the same time work has become more sedentary. As the (sedentary) work takes up a large amount of an individual's day, the health-based need to obtain sufficient amounts of regular physical activity has shifted almost entirely on free time. However, it's known that well-planned interventions may be effective in promoting physical activity on workplaces as well (Edmunds et. al., 2011). Promoting both physical and psychological well-being of employees' is potentially beneficial not only to the employees themselves but also to employers (Lerner et al., 2013; Conn et al., 2009). For these reasons, employers could take bigger role in activating their employees during working hours.

It's nice to notice that there already are some positive examples of physically more active working culture in Finnish offices. In these physically active organizations meetings by walking or even by stretching, playful competitions on push-ups, and doing sports

together with colleagues are part of everyday work. Occupational healthcare could also take more active role in supporting organizations to work and create culture like this. I see occupational health psychologist in crucial role here, as they are professionals of understanding and supporting motivation and behavioral changes.

Sufficient physical activity during both workday and leisure is important not only to our physics but also to our minds. On the other hand, experiences of stress impair efforts to be physically active, at least on those who are not used to exercise (Stults-Kolehmainen & Sinha, 2014). Again, psychologist have a role here as they can be considered as mental health professionals and hence help employees to cope with stress or diminish it, and this way find resources to exercise as well.

Occupational healthcare functions via multi-professional teams of doctors, nurses, psychologists, physiotherapists and nutritionists. It's time to utilize this huge amount of expertise in boosting wellbeing and actively preventing problems instead of just curing diseases that already exist. Psychologists paying attention to also physical activity as a part of mental wellbeing could be one step towards this.

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